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November 1, 2000

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Your ref: Q53818
Our ref.: 512992US01
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U.S. Application No.: 09/286,418

Dear Sirs

Thank you so much for your letter of September 14, 2000 providing comment on the Office Action for us.

Since the "static friction of the steering system" defined by the present invention is quite distinctive from the "road load friction" appearing in the Reference of Agarwal et al. as undermentioned. So, please respond to the Office Action by counter argument only in the Remarks without amending claims by rewriting them as the Examiner suggested. So, please argue based on the following features:

1. The electric power steering system is provided for assisting the steering torque exerted by a driver and the steering torque of the steering system is assisted through controlling the output torque of the motor coupled to the steering system based on the steering assist force which has been determined on the basis of the steering torque exerted to the steering system and the car speed, and "the road load friction (friction between the road surface and the tire surface touching with the road)" as above constitutes the main load of the power steering system and corresponds to the main load torque of the motor mentioned as above.

2. This cited reference provides a provision of the steering assist-torque having a feature such that by changing the power steering output depending on the estimation value of the main load, i.e. the "road load", the steering assist torque is adequately provided responding to the road conditions, which varies from one moment the next depending on the car speed and the weather condition, attainable without relying on the car speed signal.
- 3 The function mentioned in above (2) corresponds to the function as given in claim 1 being stated in short "driving a motor based on a steering force detection value to assist the steering force", and such a function is nothing but a function in general sense furnished to the power steering system and it is quite distinctive from the feature of the present invention as given claim 1 which is in short "compensating the static friction based on the estimated value of the static friction"
- 4 In other words, the load caused by the static friction of the steering system, which is the subject of problem to be solved, is not the load caused through the road surface friction ("road load"); but is meant by the load caused by the static friction within the components constituting the steering system such as the motor and the reduction gear and such a load remains even after the steering assist is effected in order to compensate the load caused by the road surface friction.
- 5 In this cited reference, the load caused by the static friction in the steering system is ignored. This can be presented by means of formula: in the cited reference, T_L (the road load torque) is given as, $T_L = T_D + T_M - B\theta_P - J\theta_P$. ($J\theta_P$ should be correctly expressed as $J(d\theta_P/dt)$.) On the other hand, since the present invention presents the load F caused by the static friction of the steering system as the problem to be solved, the load F caused by the static friction of the steering system, the formula should be expressed correctly with inclusion of F . So, we write:

$$T_L = T_D + T_M - B\theta_P - J(d\theta_P/dt) - F,$$
or alternatively,

$$T_{total} = T_L + F.$$
- 6 In the present invention, the load F caused by the static friction of the steering system is estimated by extracting:

(1) "the edge of the steering force detection value", in claim 2 and,

(2) "the edge of motor angular velocity or motor back electromotive force" in claim 3.

7 Though the Examiner pointed out that Agarwal et al. discloses method of estimation of the static friction by extracting the edge of the steering angle (page 2, bottom 2 lines), the thing which is pointed out by the Examiner as the edge of the steering angle is nothing but the time derivative of the steering angle ($d\theta_p/dt$) and thus this is quite distinctive from the "edge of the steering torque signal", the "edge of the steering angular velocity signal" or the "edge of the motor signal" as disclosed by the present invention.

8 This is to say that the cited reference merely carries out the estimation of the steering angular velocity from the time derivative of the steering angle and furthermore, method of estimating the load F, which is caused by the static friction in the steering system, from the steering angular velocity is neither taught nor suggested by this reference.

Please prepare the response accordingly and file it with the Patent Office in due course.

Very truly yours,

MIYAZONO INTERNATIONAL
PATENT OFFICE

S. Aotsu

Shinichi AOTSU